An insight into the solar system history through the size distribution of Jupiter's Trojans

Fumi Yoshida[1] and Tsuko Nakamura[2], [1]National Astronomical Observatory of Japan, 2-21-1, Osawa, Mitaka, Tokyo, 181-8588 JAPAN (fumi.yoshida@nao.ac.jp), [2]University of the Air

Introduction: It has been believed that Jupiter's Trojans (JTs) play an important role to understand an early stage of the solar system. In this poster, based on the newly obtained size distributions and total populations of L4 and L5 JTs, and existing theoretical researches, we would like to discuss the formation process of JTs in the history of the solar system.

Size distributions and total populations of L4 and L5 JTs from SMBAS: We investigated the data of JTs detected in Subaru Main Belt Asteroid Surveys (SMBAS), which were performed in 2001 [1][2][3][4], and found a difference in size distribution for small JTs (with D<5km) between L4 and L5 swarms [5] (see Fig. 1).

We estimated the total populations of L4 and L5 Trojans with D> 2km using a new surface number density distribution model around the L4 or L5 libration points and confirmed the asymmetry of L4 and L5 populations (the ratio of N_{L4}/N_{L5}=1.3 $\sim$ 2.5)[6]. SDSS detected about 860 candidate JTs and found the asymmetry for JTs with $D > 10$km: the ratio of N_{L4}/N_{L5}=1.6 [7]. From these results, the asymmetry of the L4 and L5 populations would be real, not observational bias.

Overall size distributions from several surveys: We examined the slopes (b) of the cumulative size distributions ($N(> D) = CD^{-b}$) using the data from several surveys and known Trojans, then listed the slopes in table 1. The slopes of cumulative size distributions for L4 and L5 Trojans with $D > 5$ km seem to be almost identical; however, the slopes are different for small JTs: b=1.3 for L4 Trojans with 2km $< D <$ 5km and b=2.1 for L5 with the same size. We made combined cumulative size distributions for each L4 and L5 swarms with the size range of 2 km $< D <\sim$ 100 km using all available size distributions of JTs and noticed that the overall size distributions of L4 and L5 Trojans are almost identical throughout the wide size range of 5 km to 93 km and there is a difference for the size distribution of smaller JTs (D<5 km) and the cumulative numbers of each swarm.

The characters of size distribution for each L4 and L5 Trojan swarms derived from observations together with theoretical researches on environments of early solar system (gas drag, planetary migrations [9][10][11]) would lead us to an insight into the solar system history.

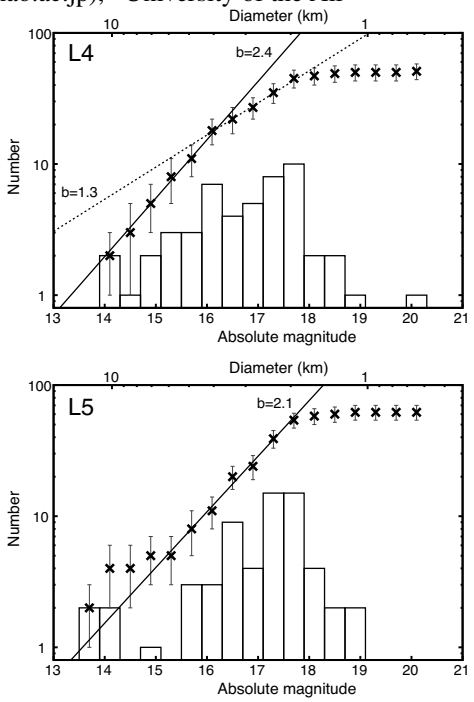

Figure 1: Size distributions of L4 and L5 Trojans from SMBASs

Table 1: Slopes of cumulative size distributions for L4 and L5 Trojans with different size ranges.

Group	Slope (b)	Size range D (km)	Reference
L4	1.3 ± 0.1	$2 < D <5$	SMBAS-I [3]
L4	2.4 ± 0.1	$5 < D <10$	SMBAS-I [3]
L4	2.0 ± 0.3	$4 < D <40$	Jewitt *et al.* (2000)[8]
L4	2.0 ± 0.1	$20 < D <93$	Known Trojan catalog*
L5	2.1 ± 0.3	$2 < D <5$	SMBAS-II[5]
L5	2.1 ± 0.1	$20 < D <93$	Known Trojan catalog*

* http://cfa-www.harvard.edu/iau/lists/JupiterTrojans.html

References: [1]Yoshida et al., (2001) PASJ, 53, L13. [2] Yoshida et al., (2003) PASJ, 55, 701. [3] Yoshida & Nakamura, (2005) AJ, 130, 2900. [4] Yoshida & Nakamura, (2007) Planetary and Space Science, 55, 1113. [5]Yoshida & Nakamura, (2008) PASJ, 60 in press. [6] Nakamura & Yoshida, (2008) PASJ, 60 in press. [7] Szabó et al., (2007) Mon. Not. R.Astron. Soc., 377, 1393. [8] Jewitt *et al.* (2000) AJ, 120,1140. [9]Peale, S. J. (1993) Icarus, 106, 308. [10] Marzari, F. & Scholl, H. (1998) Icarus, 131, 41. [11] Gomes, R. S. (1998) AJ, 116, 2590.